RCRA Facility Investigation
Workplan for
McDonnell Douglas, Hazelwood, Missouri Facility

Volume I

Prepared for:
McDonnell Douglas Aerospace
St. Louis, Missouri

Prepared by:
Environmental Science & Engineering, Inc.
St. Louis, Missouri

May 29, 1997

ESE Project No. 5197-042-0100

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RCRA PERMITTING & COMPLIANCE BRANCH
(RPCB)

MCDONNELL DOUGLAS

McDonnell Douglas Aerospace

May 30, 1997
464C-4078-JWH

Ms. JoAnn Heiman, Chief
RCRA Permitting & Compliance Branch
US Environmental Protection Agency Region VII
Air, RCRA and Toxics Division
726 Minnesota Avenue
Kansas City, Kansas 66101

Enclosure: RCRA Facility Investigation Work Plan

Dear Ms. Heiman:

The enclosed RCRA Facility Investigation Work Plan is submitted as required by Section V. of the Corrective Action Conditions of the Hazardous Waste Management Facility Permit, Number MOD 000 818 963. Three copies of the work plan will also be submitted to the Missouri Department of Natural Resources as required under the terms of the permit.

Please contact me should you need additional information.

Sincerely,

Joe Haake

Joe Haake, Group Manager
Environmental & Hazardous Materials Services
Dept. 464C/Bldg. 110/Mailcode S111-1099
(314) 232-6941

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1.0 INTRODUCTION

This document represents the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Workplan and associated support plans for Corrective Action activities to be conducted at the McDonnell Douglas (MD) facility. The MD Tract I facility (Facility) is located in Hazelwood, Missouri. The Facility location is presented in Figure 1-1.

Because of its status as a treatment, storage, or disposal (TSD) facility, the Facility is subject to the requirements of Corrective Action as outlined in the final RCRA Part B Permit No. MOD000818963. This permit was issued by the Missouri Department of Natural Resources (MDNR) on March 5, 1997 pursuant to Section 3004(u) of RCRA. This RFI Workplan has been prepared in accordance with Corrective Action Permit Conditions I, V, and XIV.

Further guidance, as needed, was obtained from documents including the "RCRA Facility Investigation Guidance" (EPA 530/SW89-031), "Test Methods for Evaluating Solid Waste" (SW-846), and other relevant U.S. Environmental Protection Agency (USEPA) publications. This RFI Workplan and the associated support plans fully comply with the Corrective Action requirements of the Facility's Part B Permit.

1.1 Purpose

The RFI Workplan presents the planned approach for characterizing the nature of any hazardous waste or hazardous constituent releases to soil from the five Solid Waste Management Units (SWMUs) identified in Condition I.A. of the Permit as requiring further investigation. Figure 1-2 displays significant features of the Facility and the locations of the SWMUs that will be investigated in the RFI.

This document and the associated support plans will provide MDNR personnel with MD's proposed technical scope of work and administrative/implementation approach for completion of RFI investigation and reporting activities. Upon review and formal approval by MDNR, this Workplan will serve as the planning and control document by which all field investigation, analytical, quality assurance/quality control, data evaluation, reporting, and project management activities will be completed. The field investigation component of the Workplan will be utilized in conjunction with two associated support plans including a Quality Assurance Project Plan (QAPP) and a Health and Safety Plan (HASP).

1.2 Workplan Organization

This Workplan is divided into eight sections of text including two appendices. A brief description of each section is presented below.

Section 1.0, Introduction, provides background information regarding the RCRA requirements for the Facility, purpose of this Workplan, and contents of this Workplan.

Section 2.0, Project Management, references the various management and administrative issues associated with the project. This section also presents the site-specific investigation objectives and data quality objectives that have been established for the Facility.

Section 3.0, Facility Background and SWMU-Specific Investigation Approaches, presents background information regarding the operations and environmental setting at the Facility. This section also summarizes SWMU-specific background information including the findings and results of the RFA sampling for each SWMU under consideration. This section also presents the sample collection and analysis approach for each SWMU under consideration.

Section 4.0, Sampling and Analysis Procedures, describes the procedures to be implemented for all field sampling and laboratory analysis activities.

Section 5.0, Evaluation of Investigation Results, describes the development, tracking, evaluation, and presentation of investigative data. The content and format of the RFI Report are also summarized.

Section 6.0, Quality Assurance/Quality Control, references the quality assurance and quality control measures to be implemented for all data collection activities.

Section 7.0, Health and Safety, references the health and safety procedures to be utilized for all field investigation activities.

Section 8.0, References, provides a list of references used within the text of this Workplan document.

Two appendices are also provided to define the associated support plans. Appendices to this document are identified below.

- Appendix A, Quality Assurance Project Plan
- Appendix B, Health and Safety Plan

2.0 PROJECT MANAGEMENT

This section describes the project management approach for the MD RFI. The section addresses various management and administrative issues associated with implementation of investigation efforts at the Facility. Specific content includes:

- Overall project objectives/requirements and approach for achieving them;
- Data quality objectives/requirements and approach for achieving them;
- Overview of the investigation strategy and technical approach;
- Project reporting;
- Project schedule; and
- Qualifications and organization of the project team, responsibilities of individual team members, lines of communication, and levels of authority.

2.1 Overview of Corrective Action Activities

The objective of the Corrective Action RFI program is to evaluate the nature and extent of releases of hazardous waste(s) and constituent(s), if any, from all applicable SWMUs identified in the Part B permit. MD has reviewed current and historic site conditions and has evaluated existing data. Thus, by design, the RFI Workplan has been developed to determine whether or not significant releases to soil have occurred, if any, for the five SWMUs of concern. The investigation work will focus on establishing site conditions in accordance with USEPA-approved quality assurance measures.

Upon approval of this RFI Workplan by MDNR, field work will be conducted in accordance with the approved plan and schedule. Upon completion of field activities and receipt/evaluation of data, MD will submit a report of findings, which will include both conclusions and recommendations regarding the RFI efforts.

2.2 Overall Project Objectives

A number of overall objectives have been developed to better guide design and implementation of RFI activities at the MD site. These objectives include:

- Comply with applicable conditions of the Permit;
- For those five SWMUs identified in the Permit, implement a RFI field investigation to identify and characterize the release of hazardous waste or hazardous waste constituents, if any, to soil at levels that present a threat to human health or the environment;
- Design the RFI to ensure the safety of MD and Environmental Science & Engineering, Inc. (ESE) personnel during implementation of field activities;

- Ensure the safety and integrity of the MD physical plant and minimize impact to ongoing commercial waste management activities at the site; and
- Prepare a report of findings for the RFI that presents conclusions regarding the presence of contamination (to the extent known based on RFI activities) and recommendations.

Completion of critical project elements and achievement of the RFI objectives will require the identification, collection, and evaluation of site-specific data and other relevant background information.

2.3 Data Quality Objectives

The data quality objective (DQO) process is based on the concept that different uses of data derived from the RFI may require different levels of data quality. USEPA guidance states that "qualitative or quantitative statements that outline the decision-making process and specify the quality and quantity of data required to support decisions should be made early in the planning stages of the RFI" (USEPA, 1984). Data quality is defined as the degree of uncertainty with respect to precision, accuracy, reproducibility, comparability, and completeness of a data set. The broad use categories and data quality levels are:

- **DQO Level I**--Provides the lowest data quality but the most rapid results. It includes field screening or analysis using portable instruments. The results are often not compound specific, nor quantitative, but the results are available in real-time. It is used for site health and safety monitoring, site characterization to select locations for further study, and general screening.
- **DQO Level II**--Field analyses using more sophisticated portable analytical instruments. In some cases, the instruments may be set up in a mobile laboratory on-site. There is a wide range in the quality of data that can be generated, depending on the use of suitable calibration standards, reference materials, and sample preparation equipment and upon the training of the operator. The results are available in real-time or in several hours. It is used where data of sufficient quality are required in a short period of time, and is usually confirmed by Level III or IV analyses.
- **DQO Level III**--Analyses are performed by an off-site analytical laboratory using standard, documented procedures. Provides a data quality suitable for site characterization and engineering evaluation and design of corrective measures. The data can also be of sufficient quality for use in risk assessment application.
- **DQO Level IV**--In general, provides the highest level of data quality and documentation. The analyses are performed in an off-site CLP analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols

and documentation. It is used for purposes of verifying engineering quality data, as necessary, and for some risk assessment applications.

The DQO process occurs in several distinct stages. These stages include the identification of objectives (Section 2.2); identification of data needs and uses (Sections 2.3.1 and 2.3.2); and design of a data collection program (Section 3.5).

2.3.1 Data Needs

During the RFI, the following data are needed to address the permit requirements and augment the conceptual model for the MD facility:

- Field data (soil boring logs and field screening results) are needed to assist in the geological/chemical characterization of soil samples that are acquired from each of the five SWMUs;
- Analytical data are needed to assess whether past waste management practices at the five SWMUs have impacted soil to the extent that it poses a human or ecological health risk, or a threat to groundwater; and
- Supplemental soil analyses are required to augment the previous analytical findings that were acquired as part of the RFA VSI sampling effort.

2.3.2 Data Usage

To establish appropriate data quality objectives, the intended use of the various data types is described below. Soil sampling data will be used to characterize the nature and extent of any releases of hazardous wastes or hazardous constituents to soil. These data may be used to determine soil cleanup objectives or support a risk assessment.

DQO Level I is sufficient for all field screening tasks.

DQO Level III, at a minimum, is required to determine soil cleanup objectives and support a risk assessment, if required. Therefore, DQO Level III is selected for soil analyses that are conducted.

2.4 RFI Strategy

2.4.1 Investigation Strategy

In order to achieve its desired objectives, MD has developed a strategy for investigating potential releases to soil from each of the five SWMUs of concern. Key elements of the strategy address a number of technical and practical considerations including:

- **Sampling Program**--Must be designed to ensure that constituents potentially present will have a high likelihood of being identified in the RFI sampling effort;

2.6 RFI Schedule

The proposed work schedule for completion of the MD RFI program is presented in Figure 2-1. Duration of MDNR review processes, which control the start date of mobilization and field activities, has been estimated based upon conversations between MDNR and MD personnel. It is anticipated that the final schedule may require modification based upon the actual review/approval process, as well as existing weather conditions at the time of MDNR approval and throughout the investigation.

2.7 Project Organization and Personnel

MD has contracted the environmental consulting firm of Environmental Science & Engineering, Inc. (ESE) to support MD in completing this RFI project. An organizational structure for the project has been developed to promote technical excellence, promote quality data collection and deliverables, enable a free flow of communications among project team members, and ensure adherence to schedule. The project organization structure is displayed in Figure 2-2. MD and ESE personnel in supervisory roles are indicated by boxes connected with solid lines of authority.

The efforts to be conducted during for the RFI have been divided into several different tasks to facilitate the most efficient use of qualified technical resources and ensure adequate oversight. All task managers report directly to the ESE Project Manager who in turn reports to the MD Project Manager. Subcontractor activities are under the direct supervision and control of the ESE Project Manager and Field Implementation Manager.

Supervisory personnel and their assigned responsibilities are described below:

MD Project Manager
Mr. Joe Haake, Manager in MD's Environmental and Hazardous Materials Services department, will serve as the MD Project Manager. He is responsible for implementing the project on behalf of MD and has the authority to commit the resources necessary to meet project objectives and requirements. The MD Project Manager's primary function is to ensure that legal, financial, technical, and scheduling objectives are achieved successfully. The MD Project Manager will serve as the primary interface with the MDNR Project Manager, Mr. Aaron Schmidt, and will provide the primary point of contact and control for matters concerning the project.

The MD Project Manager's responsibilities include:

- Coordination of MD review for all submittals and deliverables;
- Final approval of all submittals and deliverables;
- Coordination with ESE and regulatory agency personnel;
- Coordination with the ESE Project Manager to correct any problems which may arise during the course of the RFI; and
- Assuring compliance with all legal and MD contractual requirements.

As a Group Manager for MD, Mr. Haake has considerable experience negotiating permits and overseeing RCRA Corrective Action, permitting, and closure activities on behalf of the Facility.

ESE Project Manager
Mr. Doug Marian will serve as the ESE Project Manager for the MD RFI program. Mr. Marian maintains overall responsibility for ensuring that the project meets MDNR, USEPA, and MD objectives and quality standards. Reporting directly to the MD Project Manager, his primary functions include strategy development, technical quality control, ensuring appropriate MD communications with MDNR, project oversight, and daily management of all RFI activities. All ESE task managers and subcontractors report to Mr. Marian. Specific responsibilities of the ESE Project Manager include:

- Preparation and oversight of technical and administrative workplans, including approval of sampling/monitoring site locations, analytical parameters, field procedures, schedules, and manpower allocations;
- Preparation of quarterly progress reports, including schedule updates;
- Management of all funds for labor and materials procurement;
- Direct communication with the MD Project Manager;
- Technical review of all project deliverables;
- Assurance of cost-effective implementation for all project work;

MD Tract I has permitted storage facilities for wastes generated both on-site and at 9 off-site MD facilities in and around the St. Louis area. MD is also a permitted transporter (ID # H-1039) for wastes from other facilities to Tract I. MD stores hazardous waste in drums, dumpsters, and tanks at various locations around the Facility. Drums of hazardous waste generated on-site are stored at one of three less-than-90-day storage areas. These areas are located on the east side of Building 2, at Building 45E, and at Building 51. Waste solvents, paints, and oils are accumulated in drums at various satellite accumulation locations. When full, the containers are transferred to one of the less-than-90-day storage areas.

MD has two solvent distillation units that are certified as resource recovery units by MDNR. MD's resource recovery ID number is RR0268-A. One of the distillation units is used to recover spent methyl ethyl ketone (MEK) and methyl isobutyl ketone (MIBK). The distillation unit is located at the painting areas in Buildings 2. Distillation bottoms are collected in 55-gallon drums and are disposed as hazardous waste. The other distillation unit is a steam stripping carbon adsorption bed unit that recovers spent perchloroethylene (PCE). Additional detail regarding this distillation unit (SWMU No. 17) is provided in Section 3.5.1.

3.2 Environmental Setting

The Facility is surrounded by Lambert-St. Louis International Airport on the south, commercial and industrial facilities on the west and north, and the MD Tract II Facility on the east. According to information obtained from the MDNR, Division of Geology and Land Survey, no wells are located within a 1-1/2-mile radius of the Facility (RFA, 1995). Surface water from the Facility drains toward Coldwater Creek which flows along the Facility's eastern boundary.

3.2.1 Geology

Subsurface geologic units in the area of the Facility include wind or lake-deposited sediments (unconsolidated deposits) overlying nearly flat-lying sedimentary bedrock formations. These deposits may be up to 100 feet thick and consist of clay, silty clay, and some sand (Lutzen and Rockaway, 1971).

Unconsolidated deposits in the area of the Facility have been delineated by previous hydrogeologic studies conducted at the Facility (ATEC, 1990 and Riedel, 1995), as well as studies conducted at the James River Paper Company (formerly Crown-Zellerbach) located approximately 1,200 feet northwest of the Facility, and the St. Louis Airport Site (SLAPS) which adjoins the Facility to the east along Coldwater Creek. The uppermost unconsolidated deposits consist of interbedded clay, silty clay, and clayey silt with some fine-grained sand and organic matter. A dense, plastic, brown to gray-green clay unit can be present with the interbedded silty deposits. Soil sampling was conducted to a depth of approximately 30 feet at the Industrial Wastewater Treatment Plant (IWTP); results indicated the predominance of clay soils.

In areas at both facilities (MD and James River Paper Co.), up to 14 feet of clayey silt or silty clay fill material is present over the unconsolidated sequence. The fill material is composed of material either excavated at the site or brought in as clean fill during plant construction and modification activities.

The uppermost bedrock encountered in the area of the Facility is the undifferentiated Pleasanton, Marmaton, and Cherokee Groups of Pennsylvanian age. Shales, siltstones, sandstones, coal beds, and thin limestone beds are the dominant lithology of these three groups. Regionally, the Pennsylvanian-age groups have a total thickness ranging from 10 to 300 feet.

Underlying the Pennsylvanian strata is Mississippian-age limestone. The Ste. Genevieve Formation (0 to 160 feet thick), St. Louis Limestone (0 to 180 feet thick), Salem Formation (0 to 180 feet thick), and Warsaw Formation (0 to 110 feet thick) are all limestone and compose the upper portion of the Mississippian-age bedrock.

3.2.2 Hydrogeology

Water supplies in the St. Louis area are obtained from the Mississippi, Missouri, and Meramec Rivers. Approximately 82 percent of the water supply is pumped from the Mississippi River, while approximately 12 percent is pumped from the Missouri River and Meramec River combined (Miller *et al.*, 1974). Aquifers exist in both the bedrock and unconsolidated deposits along the Mississippi and Missouri Rivers. These aquifers account for approximately 3 percent of the water supply (Miller *et al.*, 1974).

As stated above, the Facility is underlain by 30+ feet of low permeability clay and silt. This material has little potential to produce water. In the vicinity of Building 40, shallow groundwater was encountered at 2 to 8 feet below land surface (bls). One notable exception was apparent in the vicinity of the IWTP where shallow groundwater was encountered at approximately 30-40 ft bls.

The shallow groundwater table may be modified locally at the Facility due to the presence of buildings or parking lots. Overall, the shallow groundwater flow direction is expected to move towards Coldwater Creek or ditches draining into this creek. Given the low permeability and thickness of the unconsolidated deposits underlying the Facility, a direct connection to deeper bedrock aquifers is not expected.

3.2.3 Surface Water Hydrogeology

General surface water drainage at the Facility is by overland flow to storm sewer intakes located across the Facility or to open drainage ditches that drain to storm sewers. The storm sewers discharge into Coldwater Creek at several locations. Coldwater Creek flows northeast within an underground culvert from the southwest side of Lambert-St. Louis International Airport, across the central portion of the airport, and the easternmost part of Tract I South. The creek flows within an open culvert north of Banshee Road along the eastern boundary of Tract I North. Coldwater Creek then flows northeast within this open culvert for several miles until it rejoins its original channel. The creek eventually discharges into the Missouri River. At its closest point, the Missouri River is approximately 3 miles to the northwest of the Facility.

3.3 Additional Facility Background References

Historic evaluations of the geology and hydrogeology at the Facility were conducted as part of previous investigations to better understand the framework for migration of any potential constituent releases and the potential effects on human health and the environment. A prior report entitled McDonnell Douglas Corporation RCRA Closure Activities, Building 14: Sludge Holding Tank Site (Riedel Environmental Services, Inc., 1995) should be referenced for additional information pertaining to the environmental setting at the Facility.

3.4 Background Soil Concentrations

Background comparisons within the RFA document were based upon the analysis of soil samples that were collected from the St. Louis Airport Site (SLAPS). These background soil samples were collected at Sacred Heart Cemetery, approximately 2 miles northwest of the Facility. Ten background soil samples from the cemetery were collected at 2-ft intervals from 0-12 ft bls. These samples were analyzed to provide background concentrations for volatile organic compounds (VOCs), base/neutral and acid extractable compounds (BNAs), and metals.

However, the SLAPS-based data are representative of background conditions for a <u>non</u>-industrialized setting. One potential source of more appropriate and representative background levels for metals is provided in the professional publication entitled *Geochemical Survey of Missouri*, USGS, 1984. This document presents a range of naturally occurring metals concentrations throughout Missouri on a geographical basis. Ranges of these USGS-based regional background concentrations for St. Louis County are summarized in Table 3-1 and will be utilized for subsequent comparative purposes.

3.5 SWMU-Specific Background and Investigation Approaches

This section of the RFI Workplan provides background information pertaining to the operational history and current usage for each of the five SWMUs under consideration. In addition, this section provides a summary of current conditions and the RFA results. This information will be used in the development of an investigation approach for each SWMU to attain the RFI objectives.

A biased sampling approach will be used to locate proposed sampling locations in and around each SWMU. The approximate locations, number of samples, and analyses have been determined using the following criteria:

- RFA soil boring and analytical results;
- SWMU layout;
- hazardous wastes or hazardous constituents managed;
- field conditions (e.g. staining, cracks, obstructions); and
- historical operations or procedures performed at the unit.

A discussion of the specific investigative approach for each SWMU is provided in the following subsections. The proposed sampling locations are approximate and subject to slight revision at the time of sampling, based on field observations and encountered conditions. Table 3-2 presents a summary of the proposed SWMU delineation parameters including SWMU identification, number of borings and samples, target constituents, analytical methods, sample selection criteria, sample collection method, and projected minimum boring depth for each SWMU.

Subsurface soil sampling will be performed to evaluate the individual SWMUs as described in the following subsections. In the event that the selected sampling method proves unsuitable at a specific location due to access restrictions, subsurface restrictions, or unsuitable soils, an alternate sampling method may be employed. Any alternate sampling methods must be capable of collecting representative samples in a manner which is consistent with the objectives of this Workplan.

The soil borings will be located at cracks in the concrete floor and other locations where the potential exists for migration to underlying soils. Due to the possible presence of buried utilities in the area, the actual sampling locations will be determined through discussions with MD facilities personnel and confirmed in the field prior to sampling.

3.5.1 SWMU No. 17 Transfer Area for Recovered PCE

3.5.1.1 Description of SWMU and Waste Management Activities

SWMU No. 17 is a continuously paved area outside of Building 51 that is used for tank transfer activities involving recovered perchloroethylene (PCE). MD initially began using this unit for PCE recovery operations on June 22, 1993. The unit contains a series of tanks which are utilized to store the separated PCE stream while being transferred from a 55-gallon tank to a 750-gallon holding tank, and finally into various 350-gallon portable tanks for off-site shipment. MD continues to use this area for PCE recovery purposes.

The referenced waste management activities are used to recover PCE from maskant that is applied to sections of various metal parts. The maskant product is a mixture of rubber-like polymers in a PCE carrier or thinner. This paint-like mixture is applied to metal parts and allowed to dry. As the parts dry, the PCE evaporates and is captured in a vapor recovery hood. Vapors from the hood are discharged to a carbon adsorption unit, where the PCE vapors are separated from the air and then transferred to a condenser, where it is recovered. The recovered PCE flows to a 55-gallon receiving tank that cycles it to the 750-gallon holding tank. Recovered PCE is then transferred from the 750-gallon holding tank into 350-gallon portable tanks for off-site shipment.

The PCE recovery unit receives PCE-laden air generated from the chemical milling operation only. Since the air is drawn from the totally enclosed part dipping, heating, and drying operations, it is not possible for any incompatible wastestreams to be mistakenly introduced into the air flow system.

Activated granular carbon represents the only residue generated from the PCE recovery process. Spent carbon is shipped off-site for incineration at approximate 5-year intervals.

3.5.1.2 Release Controls

Release controls at this unit include a stainless steel spill collection basin (12-inch sidewall height) for the 350-gallon receiving tank and a pre-fabricated containment building which prevents rainwater from reaching the unit. In addition, the unit and the immediately surrounding area have been continuously paved throughout the active waste management period to prevent any potential spills from reaching the underlying soil. The low permeability clay material throughout this area also serves to minimize the potential impact of any subsurface release.

According to the RFA, evidence of past spills was observed in the transfer area during the VSI. As a result, the RFA concluded that the asphalt around the transfer area had been damaged.

3.5.1.3 Previous Findings

Limited soil sampling activities were conducted as part of the RFA to preliminarily assess whether any releases have occurred from this unit. Two shallow soil samples (0-12 inches bls and 12-24 inches bls) were collected from one soil boring for off-site laboratory analysis.

Four VOC constituents including PCE (760 to 290,000 μg/kg), acetone (88 to 140 μg/kg), total xylenes (11 to 32 μg/kg), and 1,2-dichloroethene (1,2-DCE) (14 to 44 μg/kg) were detected in the samples and sample duplicates acquired from this unit. The shallower sample exhibited the highest PCE concentration of 290,000 μg/kg, while the field duplicate for the same depth interval exhibited a lower PCE concentration of 40,000 μg/kg.

Inorganic constituents were detected in the samples acquired from this unit. However, arsenic and selenium represent the only inorganic constituents which exceeded USGS-based regional background levels. Arsenic was detected in the deeper sample at a concentration of 46.3 mg/kg, while selenium was detected in the shallower sample at a concentration of 4.02 mg/kg.

3.5.1.4 Sample Collection Plan

Three (3) direct push/hydraulic soil probe (Geoprobe) borings will be completed to characterize the nature and extent of any potential releases from SWMU No. 17. Approximate soil boring locations are provided in Figure 3-1. The proposed borings are located along the perimeter of the area with the objective of enclosing boring locations from the RFA that exhibited detectable concentrations of PCE, acetone, 1,2-DCE, and total xylenes.

Based on an anticipated groundwater elevation of 8-12 ft bls, soil samples will be collected continuously from each Geoprobe testhole from 0 - 6 ft bls. MD will collect and submit 2 samples per boring for off-site analysis (6 total samples).

Samples will be selected for off-site analysis utilizing appropriate field screening instrumentation including a photoionization detector (PID) (for VOCs) and a x-ray fluorescence (XRF) unit (for metals). The field geologist will also retain authority to select samples on the basis of visual/olfactory means. Selected samples will be properly labeled, packaged, and shipped off-site for laboratory analysis.

Unless detectable PID readings are encountered, MD anticipates selecting samples from the 1-2 ft bls and the interval containing the highest PID readings. If PID readings are not encountered, the sample from the 5-6 ft bls interval will be selected for off-site analysis. If evidence of PCE/VOC impacts is encountered at the outermost sampling location, an additional boring(s) will be advanced at a location which is 10 ft further away from the suspected source tank. This "step-out" process will be utilized to delineate the horizontal extent of potential VOC impacts while minimizing the number of samples that are submitted for laboratory analysis. If unexpected field conditions are encountered, the ESE Field Implementation Manager will advise MD regarding any recommended changes in sampling approach.

3.5.1.5 Sample Analysis Plan

As described in Section 3.5.1.3, soil samples from the RFA VSI for this unit exhibited detectable levels of four VOCs and elevated levels of arsenic and selenium. Based on these results, the RFI soil boring samples will be selectively analyzed for VOCs and total RCRA metals (8).

VOC analyses will be performed in accordance with USEPA Method 8240. Total RCRA metals (8) analyses will be conducted in accordance with USEPA Methods 6010, 7060, 7471, and 7740.

Off-site analyses for all soil samples will be performed by ESE Laboratories in Peoria, Illinois.

3.5.2 SWMU No. 21: Industrial Wastewater Treatment Plant (IWTP) Area

3.5.2.1 Description of SWMU and Waste Management Activities

SWMU No. 21 consists of several IWTP sludge settling and equalization tanks. Principal components of the IWTP include aeration tanks, sludge settling tanks (S1 through S4), equalization tanks (E1 through E3), the sludge holding tank, and the filter press.

MD purchased the IWTP from the Metropolitan St. Louis Sewer District (MSD), converted it for treatment of MD-specific wastewaters, and began operations in July 1970. Waste management activities at this unit involve the pretreatment of rinsewater/overflows from chemical processing and electroplating operations. Hazardous waste codes assigned to the chemical processing solutions include D002, D004, D005, D006, D007, D008, and D010. MD continues to use the IWTP for wastewater treatment purposes.

The sludge settling and equalization tanks are in-ground, open top units and possess 4-inch reinforced concrete floors and 6-inch concrete walls. The tanks are connected in series from S-1 through E-3. The S-series tanks are settling tanks where sludge settles out and is separated from the water. The sludge from these tanks is pumped to the sludge collection tank. The E-series tanks are for pH adjustment (E-1) and additional settling.

3.5.2.2 Release Controls

Release controls for this unit include the low permeability clay material throughout this area which serves to minimize any subsurface release. The depth to groundwater in this area (30 to 40 feet bls) would also serve to minimize the impact of any potential release.

3.5.2.3 Previous Findings

Tanks E-2 and E-3 within SWMU No. 21 were drained in October 1993 to repair cracks that had formed in the floor. As a result, limited soil sampling activities were conducted as part of the RFA to preliminarily assess any releases from this unit. One saturated soil sample and one groundwater sample were collected from SWMU No. 21 at respective depths of approximately 22 feet bls and 35 feet bls.

VOCs were not detected in the soil sample acquired from this unit.

Inorganic constituents were detected in the soil sample acquired from this unit. However, none of the inorganic levels exceeded USGS-based regional background levels. Cyanide was detected in the soil sample at a concentration of 0.162 mg/kg.

The groundwater grab sample was only analyzed for metals due to insufficient sample volume. Various inorganic constituents were detected in this sample. However, based on the turbidity and unfiltered nature of the sample, the inorganic levels are more likely to be associated with suspended silt and clay particles, rather than being representative of aqueous phase metals.

During the RFA, a visual inspection of the sludge holding tank did not reveal any defects or evidence of wear in the liner or seams. Additional findings derived from the RCRA closure activities for the sludge holding tank are summarized in the following section.

3.5.2.4 Associated Closure Activities for Sludge Holding Tank (SWMU No. 3)

As part of the RCRA closure activities for the sludge holding tank, two soil sampling events were conducted in May 1994 and July 1995. During the May 1994 sampling event, three soil samples were collected from one soil boring in the vicinity of the sludge holding tank. Each of the three soil samples contained detectable levels of cyanide (0.16, 0.35, and 5.42 mg/kg).

Based on the reported concentration of 5.42 mg/kg cyanide in Sample DB-1 (13.9 to 18.5 feet), an additional investigation was conducted in July 1995. During this investigation, four soil borings were completed in the vicinity of the sludge holding tank and samples were collected at approximately the same depth as the bottom of the tank. An additional background sample from the southwest corner of the unit was also collected for analysis. Laboratory analytical results confirmed low levels of cyanide (0.047 to 0.116 mg/kg) that were all below the background level of 0.201 mg/kg. As a result, detected cyanide levels in the IWTP area were not indicative of a release from the IWTP unit.

3.5.2.5 Sample Collection Plan

Six (6) Geoprobe borings will be completed to characterize the nature and extent of any potential releases from SWMU No. 21. Approximate soil boring locations are provided in Figure 3-2. The proposed borings are located along the perimeter of the area with the objective of encircling the IWTP area. Consideration will also be given to incorporate the analytical results associated with the closure verification sampling efforts for the sludge holding tank.

Based on tank invert depths of approximately 20 ft bls and an anticipated groundwater elevation of 30 ft bls in this area, soil samples will be collected continuously from each Geoprobe testhole from 0 - 25 ft bls. MD will collect and submit 2 samples per boring for off-site analysis (12 total samples).

Samples will be selected for off-site analysis utilizing appropriate field screening instrumentation including a XRF unit (for metals) and PID (for supplemental verification of the absence of VOCs). The field geologist will also retain authority to select samples on the basis of visual/olfactory means. Selected samples will be properly labeled, packaged, and shipped off-site for laboratory analysis.

Unless detectable PID readings are encountered, MD anticipates selecting samples from the 1-2 ft bls and 24-25 ft bls intervals for off-site analysis. Selected samples will also be modified if XRF screening results indicate higher metal concentrations at other intervals. If unexpected field conditions are encountered, the Field Implementation Manager will advise MD regarding the recommended collection of a smaller or greater number of samples, as warranted.

3.5.2.6 Sample Analysis Plan

As described in Section 3.5.2.3, one soil sample from the RFA VSI for this unit exhibited a detected concentration of cyanide. Based on these results, the RFI soil boring samples will be selectively analyzed for total cyanide. Total RCRA metals (8) will also be analyzed to confirm levels that are consistent with USGS-based regional background standards.

Total cyanide analyses will be conducted in accordance with USEPA Method 9010. Total RCRA metals (8) analyses will be conducted in accordance with USEPA Methods 6010, 7060, 7471, and 7740.

3.5.3 SWMU No. 26: Former Less-than-90-Day Storage Building

3.5.3.1 Description of SWMU and Waste Management Activities

SWMU No. 26 consists of a pre-fabricated containment building that was located outside of Building 40 from November 1990 through July 1993. The containment structure was used as a less-than-90-day storage unit for 55-gallon drums of waste solvents, paints, and oils generated from operations inside Building 40.

In July 1993, the containment structure was replaced with a new pre-fabricated containment building that has since been used for the storage of virgin products associated with equipment use and maintenance activities (e.g. oil and gasoline).

3.5.3.2 Release Controls

Current release controls at this unit include a pre-fabricated containment building which prevents rainwater from contacting the storage drums. The area immediately surrounding the unit has been continuously paved throughout the active waste management period to prevent any potential spills from reaching the underlying soil.

According to the RFA, pavement stains and cracking were observed during the VSI which suggested that a past release from this unit had occurred. The low permeability clay material throughout this area serves to minimize the potential impact of any subsurface release. A visual inspection of the containment structure that was previously used outside Building 40 verified the integrity of its spill containment system; no evidence of staining or corrosion was observed.

3.5.3.3 Previous Findings

Limited soil sampling activities were conducted as part of the RFA to preliminarily assess whether any releases have occurred from this unit. Four shallow soil samples were collected from two soil borings for off-site laboratory analysis. The samples were collected from shallow depth intervals of 0-12 inches bls and 12-24 inches bls.

VOCs were not detected in any of the samples acquired from this unit.

Inorganic constituents were detected in the samples acquired from this unit. However, arsenic (35.6-44.8 mg/kg) was the only inorganic constituent that exceeded the USGS-based regional background levels.

3.5.3.4 Sample Collection Plan

Three (3) Geoprobe borings will be completed to characterize the nature and extent of any potential releases from SWMU No. 26. Approximate soil boring locations are provided in Figure 3-3. The proposed borings are located along with the objective of enclosing any potential releases. None of the samples collected from the VSI sampling effort exhibited detectable concentrations of VOCs or PAHs.

Based on an anticipated groundwater elevation of 8-12 ft bls, soil samples will be collected continuously from each Geoprobe testhole from 0 - 6 ft bls. MD will collect and submit 2 samples per boring for off-site analysis (6 total samples).

Samples will be selected for off-site analysis utilizing appropriate field screening instrumentation including an XRF unit (for metals) and a PID (for VOCs). The field geologist will also retain authority to select samples on the basis of visual/olfactory means. Selected samples will be properly labeled, packaged, and shipped off-site for laboratory analysis.

Unless detectable PID readings are encountered, ESE anticipates selecting samples from the 1-2 ft bls and 5-6 ft bls intervals for off-site analysis. If PID readings are encountered, we will submit the sample with the highest PID reading instead of the sample from the 5-6 ft bls interval. If unexpected field conditions are encountered, the field geologist will advise MD regarding the recommended collection of a smaller or greater number of samples, as warranted.

3.5.3.5 Sample Analysis Plan

As described in Section 3.5.3.3, soil samples from the RFA VSI for this unit exhibited elevated levels of arsenic. Based on these results and the drummed materials previously stored at this SWMU, the RFI soil boring samples will be selectively analyzed for total RCRA metals (8), as well as VOCs (to confirm absence).

Total RCRA metals (8) analyses will be conducted in accordance with USEPA Methods 6010, 7060, 7471, and 7740. VOC analyses will be performed in accordance with USEPA Method 8240.

3.5.4 SWMU No. 31 Waste Oil Tank at Building 22

3.5.4.1 Description of SWMU and Waste Management Activities

SWMU No. 31 previously consisted of a 740-gallon steel aboveground storage tank located adjacent to Building 22. The tank was used as a less-than-90-day storage unit for waste oil generated from maintenance activities in Building 22. MD is currently utilizing two double-walled tanks inside of a spill containment building for waste management activities in this area.

3.5.4.2 Release Controls

At the time of the VSI, release controls at this unit included a supporting asphalt pad for the tank and a 6-inch asphalt berm around the perimeter of the pad for spill containment purposes. The unit and the immediately surrounding area have been continuously paved throughout the active waste management period.

According to the RFA, evidence of a tank overflow was observed during the VSI on the supporting asphalt pad. In addition, minor cracks were noted along the asphalt pad. The low permeability clay material throughout this area serves to minimize the potential impact of any subsurface release.

In 1996, release controls at this unit were enhanced to include a spill collection basin surrounding the tank and a pre-fabricated containment building which prevents rainwater from reaching the unit.

3.5.4.3 Previous Findings

Limited soil sampling activities were conducted as part of the RFA to preliminarily assess whether any releases have occurred from this unit. Four shallow soil samples were collected from two soil borings for off-site laboratory analysis. The samples were collected from shallow depth intervals of 0-12 inches bls and 12-24 inches bls.

PCE was the only VOC constituent detected in the soil samples acquired from this unit. Two soil samples exhibited PCE concentrations of 10 μg/kg and 15 μg/kg which slightly exceeded the associated detection limit. PCE was detected in the deeper interval for the sample closest to the tank and in the shallower interval for the sample located further away.

Two polyaromatic hydrocarbon (PAH) constituents including fluoranthene (520 μg/kg) and pyrene (500 μg/kg) were detected in one of the samples acquired from this unit. These PAHs were only detected in the deeper interval of the sample located closest to the tank.

Inorganic constituents were detected in the samples acquired from this unit. However, arsenic, cadmium, and selenium represent the only inorganic constituents which exceeded USGS-based regional background levels. Arsenic was detected in all four samples (31.7-40.1 mg/kg), cadmium was detected in the shallower sample closest to the tank at a concentration of 1.86 mg/kg, and selenium was detected in the same sample interval and location at a concentration of 3.57 mg/kg.

3.5.4.4 Sample Collection Plan

Three (3) Geoprobe borings will be completed to characterize the nature and extent of any potential releases from SWMU No. 31. Approximate soil boring locations are provided in Figure 3-4. The proposed borings are located along the perimeter of the area with the objective of enclosing boring locations from the RFA that exhibited detectable concentrations of PCE and two PAHs.

Based on an anticipated groundwater elevation of 8-12 ft bls, soil samples will be collected continuously from each Geoprobe testhole from 0 - 6 ft bls. MD will collect and submit 2 samples per boring for off-site analysis (6 total samples).

Samples will be selected for off-site analysis utilizing appropriate field screening instrumentation including a UV fluorescence analyzer (for waste oil constituents), a XRF unit (for metals), and a PID (for VOCs). The field geologist will also retain authority to select samples on the basis of visual/olfactory means. Selected samples will be properly labeled, packaged, and shipped off-site for laboratory analysis.

Unless detectable PID readings are encountered, ESE anticipates selecting samples from the 1-2 ft bls and 5-6 ft bls intervals for off-site analysis. If PID readings are encountered, we will submit the sample with the highest PID reading instead of the sample from the 5-6 ft bls interval. If unexpected field conditions are encountered, the field geologist will advise MD regarding the recommended collection of a smaller or greater number of samples, as warranted.

3.5.4.5 Sample Analysis Plan

As described in Section 3.5.4.3, soil samples from the RFA VSI for this unit exhibited detectable levels of PCE (10 and 15 μg/kg) and two PAHs, as well as elevated levels of arsenic, cadmium, and selenium. Based on these results, the RFI soil boring samples will be selectively analyzed for VOCs, PAHs, and total RCRA metals (8).

VOC analyses will be performed in accordance with USEPA Method 8240. PAH analyses will be conducted in accordance with USEPA Method 8310. Total RCRA metals (8) analyses will be conducted in accordance with USEPA Methods 6010, 7060, 7471, and 7740.

3.5.5 SWMU No. 10: Waste Oil Tank at Building 5

3.5.5.1 Description of SWMU and Waste Management Activities

SWMU No. 10 is a 375-gallon steel aboveground storage tank located adjacent to Building 5. The tank has been used since December 23, 1988 as a storage unit for waste oil that has been separated from condensate of an oil-lubricated, steam-operated air compressor inside Building 5. MD continues to use this unit for waste management activities.

The tank is filled automatically from an oil-water separator that receives the discharge stream from the air compressor. Once the tank becomes full, waste oil is subsequently transferred from the tank to a mobile 1,000-gallon tank at approximate 3-5 month intervals. The mobile tank is then moved to the permitted hazardous waste storage area (Scrap Dock Shelter, SWMU No. 8) where the waste oil is transferred to a tanker truck for transport to an off-site fuel blending facility.

3.5.5.2 Release Controls

Release controls at this unit include the 1/2-inch tank construction which prevents leaks and enables easy detection of any overflow condition. Supplemental release controls include an asphalt pad underlain with concrete and a 4-inch asphalt berm around the perimeter of the pad for spill containment purposes. In addition, the unit and the immediately surrounding area have been continuously paved throughout the active waste management period to prevent any potential spills from reaching the underlying soil.

According to the RFA, evidence of past spills was observed during the VSI on the supporting asphalt pad. The low permeability clay material throughout this area serves to minimize the potential impact of any subsurface release.

3.5.5.3 Previous Findings

Limited soil sampling activities were conducted as part of the RFA to preliminarily assess the impacts of any past releases from this unit. Four shallow soil samples were collected from two soil borings for off-site laboratory analysis. The samples were collected from shallow depth intervals of 0-12 inches bls and 12-24 inches bls.

PCE was the only VOC constituent detected in one of the four soil samples acquired from this unit. The sample from the shallower sample located closest to the tank exhibited a PCE concentration of 50 μg/kg. However, PCE was also detected in the field blank for the same location.

Eleven PAH constituents including anthracene, benzo(a)anthracene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene were detected in the samples acquired from this unit.

Inorganic constituents were detected in the samples acquired from this unit. However, arsenic was the only inorganic constituent that exceeded USGS-based regional background levels. The sample from the deeper sample located closest to the tank exhibited an arsenic concentration of 37.5 mg/kg.

3.5.5.4 Sample Collection Plan

Three (3) Geoprobe borings will be completed to characterize the nature and extent of any potential releases from SWMU No. 10. Approximate soil boring locations are provided in Figure 3-5. The proposed borings are located along the perimeter of the area with the objective of enclosing boring locations from the RFA that exhibited detectable concentrations of PCE and eleven PAHs.

Based on an anticipated groundwater elevation of 8-12 ft bls, soil samples will be collected continuously from each Geoprobe testhole from 0 - 6 ft bls. MD will collect and submit 2 samples per boring for off-site analysis (6 total samples).

Samples will be selected for off-site analysis utilizing appropriate field screening instrumentation including UV fluorescence analyzers (for waste oil constituents), XRF units (for metals), and PIDs (for VOCs). The field geologist will also retain authority to select samples on the basis of visual/olfactory means. Selected samples will be properly labeled, packaged, and shipped off-site for laboratory analysis.

Unless detectable PID readings are encountered, ESE anticipates selecting samples from the 1-2 ft bls and 5-6 ft bls intervals for off-site analysis. If PID readings are encountered, we will submit the sample with the highest PID reading instead of the sample from the 5-6 ft bls interval. If unexpected field conditions are encountered, the field geologist will advise MD regarding the recommended collection of a smaller or greater number of samples, as warranted.

3.5.5.5 Sample Analysis Plan

As described in Section 3.5.5.3, soil samples from the RFA VSI for this unit exhibited detectable levels of PCE (50 μg/kg) and 11 PAHs, as well as elevated levels of arsenic. Based on these results, the RFI soil boring samples will be selectively analyzed for VOCs, PAHs, and total RCRA metals (8).

VOC analyses will be performed in accordance with USEPA Method 8240. PAH analyses will be conducted in accordance with USEPA Method 8310. Total RCRA metals (8) analyses will be conducted in accordance with USEPA Methods 6010, 7060, 7471, and 7740.

3.5.6 Sampling Re-Cap

Based on the SWMU-specific approaches previously described, MD anticipates that approximately 18 Geoprobe soil borings will be required resulting in a total of 36 samples being submitted for off-site analysis. Analyses will be performed based on the specific characteristics and VSI-based analytical findings for each SWMU.

3.6 Conceptual Model Summary

A conceptual model of the Facility has been developed to succinctly define the environmental setting, Facility operations, and nature of contamination at the site. This integrated conceptual model is used to provide a better understanding of how released constituents, if any, might impact relevant migration pathways and potential receptors. Thus, the presence of site contaminants can be placed into proper perspective in order to determine the "true" risk posed at the Facility.

The initial conceptual model of the Facility has been developed based on available background information. This background information includes:

- Records regarding Facility operations and current/historical waste management practices presented in the RFA;
- Published literature regarding subsurface hydrogeologic conditions in the vicinity of the Facility; and
- Analytical data for soil samples collected at the Facility.

The conceptual model is summarized as follows:

<u>Facility Setting</u>

- The approximate 133-acre Facility is situated at an elevation of approximately 500 feet above mean sea level. Surface water runoff flows through ditches and storm drains to Coldwater Creek, that eventually flow to the Missouri River.
- The Facility is located in a highly urbanized setting, and the immediately surrounding area is developed with Lambert-St. Louis International Airport to the south, commercial and industrial facilities to the west and north, and some residential areas to the east.

<u>Current and Historical Operations</u>

- McDonnell Douglas manufactures combat aircraft, transport aircraft, space systems and missiles and information systems. MD is a large quantity generator of hazardous waste. MD's principal wastestreams include emulsified cutting oil, paint solids, waste solvents, paint waste, wastewater treatment sludge, and acid/caustic wastes.
- Based on the findings of the RFA (MDNR, 1995), five SWMUs were identified within the Part B Permit as requiring further investigation. These SWMUs were identified on the basis of waste management practices and known/potential releases within these areas.

<u>Environmental Setting</u>

- The Facility lies in a level topographical area known as the Florissant Basin. Land surfaces in the vicinity slope in a general north and east direction toward Coldwater Creek.
- Locally, low permeability unconsolidated glacial wind or lake deposits overlie Pennsylvanian age shale, limestone, sandstones, and coal beds. The unconsolidated deposits may be 100 feet in thickness. The bedrock in the area of the Facility is not a significant source of groundwater.
- Previous studies at the Facility indicate that shallow groundwater occurs at an approximate depth of 2-30 feet bls. Local shallow groundwater depth and flow directions may be affected by buildings and parking lots.

<u>Nature and Extent of Contamination</u>

- Analytical data for soil is available from preliminary sampling completed as part of the RFA, as well as from RCRA Closure activities for the wastewater sludge holding tank (SWMU No. 3).
- Soil samples collected from borings at the Facility indicate the presence of elevated concentrations of metals (arsenic, cadmium, and selenium), detectable levels of VOCs (PCE, acetone, 1,2-DCE, and total xylenes), PAHs, and cyanide.
- The Facility does not contain features that typically raise concern regarding air emissions such as open waste piles, surface impoundments, and land treatment units.
- Buried wastes are not known to be present at the Facility, and therefore soil gas impacts are not anticipated.

4.0 SAMPLING AND ANALYSIS PROCEDURES

This section describes the soil sample collection and laboratory analysis procedures.

4.1 Direct Push Sampling Technology

Direct push/hydraulic soil probe (Geoprobe) subsurface sampling equipment will be utilized as the primary drilling methodology wherever site conditions permit its use. Geoprobe equipment will be mounted on a truck or all terrain vehicle (ATV) for subsurface investigations.

The hydraulic soil probe technology utilizes static and percussion forces to drive probing and sampling tools into the subsurface. The thin-walled soil sampling tube remains completely sealed as it is driven to the desired sampling depth by steel probing rods. An internal piston is then manually released allowing soil to enter the sampling tube, which is lined with a disposable polybutylate (acetate) liner. The sampling tube is then driven further to collect the soil from the desired depth interval. The sampling tube is withdrawn and the polybutylate-encased sample is removed from the sampling tube.

An aliquot of sample will be placed directly into the appropriate sample container from each sampling location. No compositing of samples shall be performed. The samples collected for VOC analysis will be filled to the top of the jar to minimize the amount of headspace in the jar which may result in the loss of volatile compounds from the sample. Samples collected for organic analysis shall be immediately placed into an iced sample cooler to prevent the loss of volatile compounds. Soil samples collected for metals analysis will be collected by placing an aliquot of soil into an appropriate glass sample container. Sample container requirements are discussed in the Quality Assurance Project Plan (QAPP).

To prevent cross-contamination between samples, the sampler shall wear disposable latex gloves during the collection of the samples. The sampler shall don a new pair of disposable gloves before collecting each sample. Also, the sampler shall decontaminate the sampling devices prior to each use. Decontamination procedures are discussed in the QAPP.

Following completion, each boring will be grouted with granular bentonite to surface and hydrated. Each boring will be sealed at the surface with concrete or asphalt. Soil cuttings will be containerized in 55-gallon DOT-approved drums and stored for subsequent disposal as discussed in the QAPP. Any decontamination liquids generated will be disposed of at the IWTP.

4.2 Field Screening and Sample Selection Procedures

4.2.1 FID/PID Screening for VOCs

Each soil sample will be screened in the field with a photoionization detector (PID) for total organic vapors (TOV) by the headspace method. This will involve placing a portion of the soil sample into a resealable plastic bag or similar container and allowing time for volatilization, if any, to occur. The concentration of VOCs that partition from the soil to the gaseous state are then recorded in parts per million (ppm) by placing the PID probe into the container headspace.

The PID will be calibrated at a minimum of once per day during the RFI field effort. Instrument calibration will be performed in accordance with the manufacturers' recommended procedures using either commercially available or laboratory-provided calibration standards. All calibration data will be recorded in the Field Equipment Calibration Logbook.

4.2.2 UV/Fluorescence Screening for Waste Oil Constituents

Soil samples will be screened in the field to determine potential waste oil presence by UV fluorescence. Most waste oil constituents will fluoresce, including all aromatic or polyaromatic hydrocarbons. It is sometimes necessary to use extractants (acetone, etc.) to leach cuttings from the sample matrix. A soil sample aliquot will be placed within a UV lamp metal viewing box and the amount/color of fluorescence observed. Samples with the highest, if any, UV fluorescence will be selected for laboratory analysis.

4.2.3 X-Ray Fluorescence (XRF) Screening for Metals

To identify potential soil intervals with high metal levels for subsequent laboratory analysis, selected soil samples will be screened in the field for metals via a Spectrace Instruments model Spectrace 9000 FPXRF analyzer. The Spectrace 9000 is accepted as fulfilling USEPA QA1 and QA2 data quality objectives according to the Office of Solid Waste and Emergency Response (OSWER) Directive 9360.4-01, Quality Assurance/Quality Control Guidance for Removal Activities-Sampling QA/QC Plan and Data Validation Procedures, April 1990.

Sample preparation will include the removal of any organic matter, large rocks or debris from the sample, passing the sample through a 10-mesh sieve, and thoroughly mixing the sample prior to containerization in a sample cup. The sample is then containerized in a 31-mm X-ray sample cup and covered with 0.2-mil (ml) polypropylene X-ray film for analysis. Disposable equipment utilized includes sampling gloves, the 31-mm X-ray sample cup, and the 0.2-ml X-ray film. The 10-mesh sieve is decontaminated prior to use, between samples prepared, and prior to departure from the site.

4.3 Sample Collection Procedures

It is anticipated that two soil samples will be collected from each boring for laboratory analysis using the 4-ft Geoprobe sampler. The soil samples will be collected continuously. In the event that coarse gravel fill material is encountered below the concrete and collection of sufficient soil volume is not possible, the borings will be advanced until a finer-grained material (i.e., sand, silt or clay) is encountered, and the sample then collected.

The results of the field screening (PID, UV fluorescence, or XRF units) will be utilized in the selection of sample intervals. The sample with the highest TOV, UV fluorescence, or XRF levels will be submitted for chemical analysis. Visual observations by the field geologist will also be considered in the sample selection process. Refer to Sections 3.5.1 through 3.5.5 for SWMU-specific screening criteria and anticipated sample depths.

Soil samples will be collected from the borings for submittal for chemical analysis of selected VOCs, PAHs, RCRA metals, or cyanide according to the target constituent list identified for each specific SWMU. The analytical parameters to be used for the assessment of this area were selected based on RFI results and knowledge of chemical usage for each unit.

4.4 Quality Assurance/Quality Control Samples

In accordance with the Data Collection Quality Assurance Project Plan (QAPP) as presented in Appendix A, one duplicate soil sample will be collected and analyzed per twenty soil samples. The soil duplicate samples will be analyzed for VOCs, PAHs, total RCRA Metals (8), and total cyanide.

4.5 Sample Management, Preservation, and Chain-of-Custody Procedures

Upon collection, each soil sample will be managed according to the procedures described in this subsection. These procedures have been established in accordance with the QAPP as presented in Appendix A. Appropriate USEPA analytical methods, sample preservation techniques, sample volumes, and holding times are also presented in the QAPP.

4.5.1 Sample Containers

Samples will be collected into sample containers which have been pre-cleaned and assembled to USEPA's Protocol "B". The volume of sample collected and the type of container used will be determined by the suggested volumes described in SW-846 for the particular analysis. A summary of the bottle requirements and sample volumes is included in the QAPP provided in Appendix A.

4.5.2 Sample Management

Immediately upon collection, each sample will be properly labeled to prevent misidentification. The sample labels will include the sample number, the sample location, the sample depth, the date sampled, the time sampled, the analyses to be performed, and the sample collector's name. The sample labels will be affixed to the sample jar immediately upon collection. The sample labels will be made of waterproof material and filled out with waterproof ink.

After labeling, the samples will be placed into an appropriate shipping container. Samples collected for organic analysis will be placed into a shipping container with sufficient ice or ice packs to maintain an internal temperature of four-degrees (4°) Celsius during transport to the laboratory. The samples will be appropriately packaged in the shipping container to minimize the potential for damage during shipment. A completed chain-of-custody form will be placed in each shipping container to accompany the samples to the laboratory. The shipping containers will then be sealed with several strips of strapping tape.

The sample containers will be shipped via overnight courier (such as Federal Express) to ESE Laboratories in Peoria, Illinois. Samples will be shipped so that no more than 24 hours elapse from the time of shipment to the time the laboratory receives the samples. The method of sample shipment will be noted on the chain-of-custody forms accompanying the samples. Strict chain-of-custody procedures will be maintained during sample handling.

4.5.3 Preservation

Soil samples for organic analyses will be preserved by placing each sample immediately into a cooler with sufficient ice or ice pack material to maintain a temperature of 4-degrees (4°) Celsius or less during transport to the laboratory. Sample preservation is not required for soil samples collected for metals analysis. The required sample preservation methods for the specific constituents are included in the QAPP in Appendix A.

4.5.4 Chain of Custody

A chain-of-custody program will be followed to track the possession and handling of individual samples from time of collection through completion of laboratory analysis. Copies of the chain-of-custody record will be retained in the permanent file for proper documentation. The chain-of-custody forms shall include at a minimum:

- Sample number;
- Date and time of collection;
- Sample type (e.g., soil, groundwater, etc.);
- Parameters requested for analysis;

- Signature of person(s) involved in the chain of possession; and
- Inclusive dates of possession.

4.6 Analytical Methods

The soil samples will be submitted to ESE's IEPA-approved laboratory in Peoria, Illinois for analysis. Sample analyses shall be conducted for selected VOCs, PAHs, metals, and cyanide in accordance with the methodology described in Section 3.5.1 through 3.5.5. Table 3-2 lists the specific constituents to be analyzed at each SWMU. Laboratory quality assurance/quality control procedures will comply with the requirements of Appendix A.

4.7 Equipment Decontamination Procedures

All drilling and sampling equipment will be decontaminated prior to initial use at the Facility. Decontamination of Geoprobe equipment and other pieces of equipment will be performed at the drilling locations. Rinsewaters will be collected into a bucket or drum.

To prevent possible cross-contamination between samples, all down-hole drilling tools and sampling equipment will also be decontaminated between boring locations. Decontamination procedures for sampling equipment will consist of a wash of an Alconox solution, a potable/tap water rinse, followed by a distilled water rinse.

4.8 Waste Collection and Disposal Procedures

Waste materials derived from the field investigation, such as drill cuttings, decontamination rinsewaters, and personal protective equipment, will be collected in DOT-approved 55-gallon drums. The collected waste materials will be segregated into drums based on waste medium (water, soils, etc.). Each drum will be clearly labeled to indicate the type and approximate volume of contents, source, accumulation start date, and signature of the person completing the label.

The drums will be stored at an on-site location that will not disrupt Facility activities, yet provide a sufficient degree of security to deter any tampering with their contents. Equipment decontamination rinsewaters will be transferred to the influent of the IWTP where they will be treated to meet discharge standards in a similar manner with the chemical process influent. Drums with solid materials will remain on-site until proper disposal arrangements are completed by MD.

5.0 EVALUATION OF INVESTIGATION RESULTS

This section describes the data management system (DMS) that will be used for the RFI. This section also provides a summary of the data evaluation process and its subsequent presentation in the RFI Report.

5.1 Data Management System

The primary purpose of the DMS is to document and track investigation data and results acquired during the RFI. Its secondary purpose is to enhance the ability of the data to be presented graphically in reports and presentations.

The DMS encompasses the overall management of field and laboratory data from the time it is first generated, through entry into and use within a computer database system, to presentation as tables, charts, graphs, maps, and cross-sections. The DMS for the MD RFI will manage the following types of data including analytical results for soil samples, subsurface exploration logs, and monitoring/sampling procedures.

5.2 Establishment of Data Record

Field investigation activities will mark the initial establishment of the data record. Field measurements, general observations, and documentation of daily activities will be recorded in bound, numbered field notebooks. Each page of the notebook will bear the signature of the field team member recording the information on the page. Errors will be stricken with a single line and initialed.

Specific information relative to the collected soil samples will be recorded on Sample Log Sheets. Log sheets will be bound together in a notebook upon completion of the RFI field activities.

A data record will be created for each sample collected during the RFI. Each sample will be given a unique alpha-numeric code, as discussed in Appendix A, which will serve as its data record number. The following will also be included in each data record:

- sample media (soil);
- sample location and depth (included in the unique alpha-numeric code);
- sample date, person who collected sample, date shipped to laboratory, chain of custody number; and,
- date sample received and date analyzed by lab, laboratory identification number, analytical methods used, analytical results with qualifiers (if any) and associated QA/QC data.

Upon receipt of samples by the ESE laboratory in Peoria, each unique sample number will be entered into ESE's CLASS system by the sample custodian receiving the samples. This computerized system tracks each individual sample within the laboratory and through the independent QA evaluation. Analytical data will be submitted to the project team in both an electronic format and selective tables as generated by the CLASS system. Raw data will be kept in the permanent laboratory file. The QA summary report prepared as part of the independent QA evaluation will be submitted to the project team and maintained in the permanent project file.

Given the types and quantities of data to be collected during the RFI, it is anticipated that this data will be maintained on a Excel/Microsoft Access spreadsheet/database system for data evaluation and interpretation.

5.3 Data Management and Quality Control

As part of data evaluation, quality assurance/quality control (QA/QC) measures will be taken to ensure the data is accurate. Three levels of review for QA/QC are incorporated into the DMS as follows:

- raw data prior to input to computer database files;
- computer database files, as a check on input procedures; and,
- computer database output, to check that the database was correctly used to prepare the output.

The ESE Quality Assurance Officer is responsible for the Level 1 QA/QC review of all non-laboratory field data. The Data Validator is responsible for QA/QC review of all laboratory data and all internal database and output QA/QC reviews.

The DMS provides a structure for handling and evaluating RFI data, and verifying accuracy using the following steps:

- "Raw" data will be compiled in "working files", including the existing site data, and the field and laboratory reports prepared while implementing the RFI Workplan. Generally, these will be paper (i.e., hard copy) files; and,
- A Level 1 QA/QC review process will be performed on the working files until these are considered complete and correct. After the Level 1 QA/QC procedure is performed, the files will become hard copy "record files". In some cases (e.g., for laboratory analytical data), the hard copy record files will be transmitted from the ESE laboratory by fax modem, after the Level 1 QA/QC review has been completed. This will allow direct data input to the computer database system.

The existing data will be assumed to be essentially correct at the time they are obtained by ESE and will not be edited prior to input, except in the case of clear and obvious errors, such as use of incorrect units or typographical errors.

For data obtained during the RFI, the Level 1 QA/QC procedure will include a review of all data points in field and laboratory reports for completeness, indications of aberrations, adherence to and interferences with specified procedures, and reasonability. Edits will be made, where needed, to transform the working files into record files which are considered complete and correct. Examples of such edits are correcting a mistyped boring identification number on a laboratory report, refining field soil descriptions based on an in-house review of jar samples of the soil, or "flagging" a data point because of an aberration (e.g., intended detection limit not achieved due to high matrix interference).

Additional steps will be followed for data obtained during the RFI:

- Record file data will be input to the working files of the computer database system, either by manual data entry or electronic file transfer, depending on the type of record file;
- A Level 2 QA/QC review will be performed for the working files of the computer database system, to establish the integrity of the data input procedures. This review will be done by comparing selected data points in the electronic database files with the record files, and making edits as needed, until the database files and the record files are considered identical. When they are considered identical, the computer database system files will be considered database system record files. Electronic memory backup files will be made of the computer database system record files. Through the course of the RFI process, updated memory backup files will be made when the database system record files are added to or otherwise modified;
- Data from the database system record files will be manipulated (i.e., accessed and "used") using query programs. The query programs will allow data to be analyzed and summarized for presentation purposes (e.g., as tables and maps); and,
- A Level 3 QA/QC review will be performed on output from the query programs, to assure that the programs are correctly written and used. This will be done by manually calculating select portions of the output and comparing these with the computer generated data. After any required edits to the programs are made and checked, the database system output will be prepared as presentation quality or interpretation quality documents. At this stage the output documents will be considered correct. [Note: Interpretation quality output are for the use of project scientists and engineers during their work in interpreting the RFI data, and are not

necessarily in presentation quality format suitable for inclusion in final documents (e.g., with respect to column order on tables, or notes on figures)].

5.4 Data Output, Evaluation, and Presentation

Data output from the DMS can be generated in a variety of formats including text and graphical printouts, spreadsheet form (e.g., Excel), or ASCII file form. The ASCII file output can be utilized directly by other software to produce contour maps and graphs, or to serve as input for analytical/numerical models.

The data will be evaluated to ensure its consistency and completeness with respect to the project objectives. These project objectives were developed to characterize any release of hazardous wastes or hazardous constituents to soil. In addition, data acquired from the boring logs will be assimilated to define the geological subsurface environment.

Investigation data and the associated conclusions will be presented in the form of a RFI Report. In the report, data will be summarized in logical formats that can be readily used in the decision-making process. The RFI Report will present summaries of all validated data obtained during the investigation.

ESE will use its CLASS data management system to generate constituent summary tables for the RFI Report. The system allows easy and quick manipulation of data to provide summary tables such as a positive hit data table. The positive hit table is generated by first selecting any analyte detected in any sample and then developing a table, using that list of analytes, for all samples of interest. As an example of this approach, analytical soil data will be compared to appropriate action levels to determine the nature and extent of any potential releases at the Facility.

The RFI Report may include graphic representation of physical and chemical data using a combination of contouring, graphing, and drafting software (e.g., Surfer® Grapher®, MODFLOW and Autocad Release 13®). Figures presenting constituent concentrations superimposed over sample locations may be used to present analytical data. Geological information from soil boring logs may be presented in the form of geological cross-sections.

The results of this data evaluation process will be presented in the RFI Report through the use of summary tables and written discussions. Selected raw data such as CLASS printouts of analytical results and geological logs may be included as appendices to the RFI Report.

5.5 RFI Report

The RFI Report will provide a detailed summary of the RFI field activities, field and analytical data results, and conclusions drawn from these results. Report content will include, but not be limited to, sections which address the following topics:

- executive summary;
- description of the Facility and the SWMUs investigated;
- summary of the field activities conducted;
- discussion of the geological system beneath the Facility;
- description of sampling locations;
- presentation of field and analytical results;
- discussion of the nature/extent of any hazardous constituent releases to soil; and

The Report will demonstrate, to the extent possible, that the data presented are sufficient to describe the nature and extent of any releases to soil and define the geological system at the Facility.

6.0 QUALITY ASSURANCE / QUALITY CONTROL

This section summarizes the quality assurance procedures that have been developed for the RFI. These procedures have been established to ensure the validity of the data collected during the investigation. Detailed quality assurance procedures for the field investigation and analytical laboratory requirements of this project are provided in the Quality Assurance Project Plan (QAPP). A copy of the QAPP is provided in Appendix A to this Workplan.

The QAPP identifies the quality assurance procedures that are required to meet the data quality objectives for the project. These procedures address the following issues:

- quality assurance objectives in terms of precision, accuracy, completeness, comparability, and representativeness;
- procedures for the screening of existing data;
- data management, reduction, validation, and reporting;
- overview of both field and laboratory QC checks and their frequencies, control limits, and corrective actions; and,
- data assessment procedures.

6.1 Field Quality Assurance/Quality Control Measures

Quality assurance of the field data will be maintained by field team personnel who are involved with the collection and handling of the required data. Each individual is required to perform specific tasks and document the completion of each task. Field quality assurance/quality control for this project shall be maintained by proper documentation of the actual work performed including date of performed work, daily project tasks, sample locations, sample collection times, specific field observations, weather conditions, air monitoring results, and identification of assigned field personnel. Documentation of the work performed shall be in the form of a field log book maintained by the field supervisor.

Quality control of the field data will be maintained through the collection of soil duplicate, equipment blank, and trip blank samples. Analysis of these samples will facilitate an evaluation of the sample collection and handling procedures, as well as the reproducibility of the data.

One (1) soil duplicate sample will be acquired for every 20 samples collected, or a minimum of one (1) sample every day of field sampling activities, to allow an evaluation of the reproducibility of the data. Duplicate samples will be acquired by collecting a sample volume from a selected location which is equal to twice the typically required sample volume. The sample volume will be split and placed into appropriate sample containers to produce two (2) separate laboratory

8.0 REFERENCES

The following list includes references cited in the text and general references used in the preparation of the RFI Workplan that were not specifically cited in the text.

Lutzen, E. and J. Rockaway. 1971. Engineering Geology of St. Louis County, Missouri. Engineering Geology Series No. 4.

Miller, D., *et al*. 1974. Water Resources of the St. Louis Area, Missouri. USGS and Missouri Geological Survey and Water Resources.

Missouri Department of Natural Resources, Part I RCRA Permit, USEPA ID No. MOD000818963, March 5, 1997.

Riedel Environmental Services, Inc., McDonnell Douglas Corporation RCRA Closure Activities, Building 14: Sludge Holding Tank Site, August 1995.

United States Environmental Protection Agency, Region VII, RCRA Facility Assessment, McDonnell-Douglas Corporation, Hazelwood, Missouri (Prepared by Science Applications International Corporation), April 1995.

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United States Environmental Protection Agency, Test Methods for Evaluating Solid Waste, SW-846, 1992.

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United States Environmental Protection Agency, USEPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, USEPA QA/R-5, May 1994.

United States Geological Survey. 1984. Survey of Missouri, Geological Survey Professional Paper. 954-H, I.

Tables

Table 3-1. USGS-Based Regional and SLAPS Background Metal Concentrations in Soil

Metal Constituent	USGS-Based Regional Concentration Range (St. Louis County, Missouri)	SLAPS Background Range
Aluminum	40,000 to 80,000	4,140 to 7,880
Arsenic	6.3 to 77*	0.8 to 11.9
Barium	600 to 1,750	40.7 to 279
Beryllium	ND to 1.25	0.3 to 0.6
Cadmium	ND	ND
Chromium	25 to 85	8.6 to 12
Cobalt	ND to 12	5.5 to 9.6
Lead	ND to 85	7.3 to 30.9
Manganese	ND to 3,500	68.3 to 4,690
Mercury	0.22 to 0.965	no data
Nickel	9 to 80	8.5 to 23.4
Selenium	0.1 to 2.5	ND
Vanadium	60 to 150	8.5 to 16.3
Zinc	50 to 620	29.8 to 52.8

* Most concentrations below 30 mg/kg.
ND = Not detected.

TABLE 3-2 **SUMMARY OF PROPOSED SWMU DELINEATION PARAMETERS**
RFI WORKPLAN for McDONNELL DOUGLAS
HAZELWOOD, MISSOURI FACILITY

SWMU ID	No. of Borings	No. of Sples	Target Analytical Constituents	SW 846 Method	Sample Selection Criteria	Projected Sampling Intervals	Investig. Method	Projected Boring Depth (1)	Comments
No. 17: Transfer Area for Recovered PCE	3	6	VOCs RCRA Metals (8)	8240 6010,7060 7471,7740	VOCs - Highest PID/Greatest Depth Metals - XRF/Staining	1-2 ft bls; and highest PID OR 5-6 ft bls	Geoprobe	6 ft	10-ft horizontal step-outs if PCE/VOC impacts are evident.
No. 21: Industrial Wastewater Treatment Facility Area	6	12	Cyanide RCRA Metals (8)	9010 6010,7060 7471,7740	CN - Staining/Greatest Depth Metals - XRF/Staining	1-2 ft bls; and 24-25 ft bls OR highest XRF	Geoprobe	30 ft	Supplemental reliance upon analytical results from tank closure proceedings.
No. 26: Former Less-than-90-Day Storage Building	3	6	RCRA Metals (8) VOCs	6010,7060 7471,7060 8240	Metals - XRF/Staining VOCs - Highest PID/Greatest Depth	1-2 ft bls; and 5-6 ft bls OR highest PID	Geoprobe	10 ft	Analytical constituents based upon contents of previously stored drums.
No. 31: Waste Oil Tank at Building 22	3	6	VOCs PAHs RCRA Metals (8)	8240 8310 6010,7060 7471,7740	VOCs - Highest PID/Greatest Depth PAHs- UV/Fluor / Staining Metals - XRF/Staining	1-2 ft bls; and 5-6 ft bls OR highest PID	Geoprobe	10 ft	Supplemental VOC analysis to confirm absence of trace levels that were detected in VSI.
No. 10: Waste Oil Tank at Building 5	3	6	VOCs PAHs RCRA Metals (8)	8240 8310 6010,7060 7471,7740	VOCs - Highest PID/Greatest Depth PAHs- UV/Fluor / Staining Metals - XRF/Staining	1-2 ft bls; and 5-6 ft bls OR highest PID	Geoprobe	10 ft	Supplemental VOC analysis to confirm absence of trace levels that were detected in VSI.
TOTAL	18	36							

Notes:
1) Vertical delineation depth subject to field modifications.

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Figures

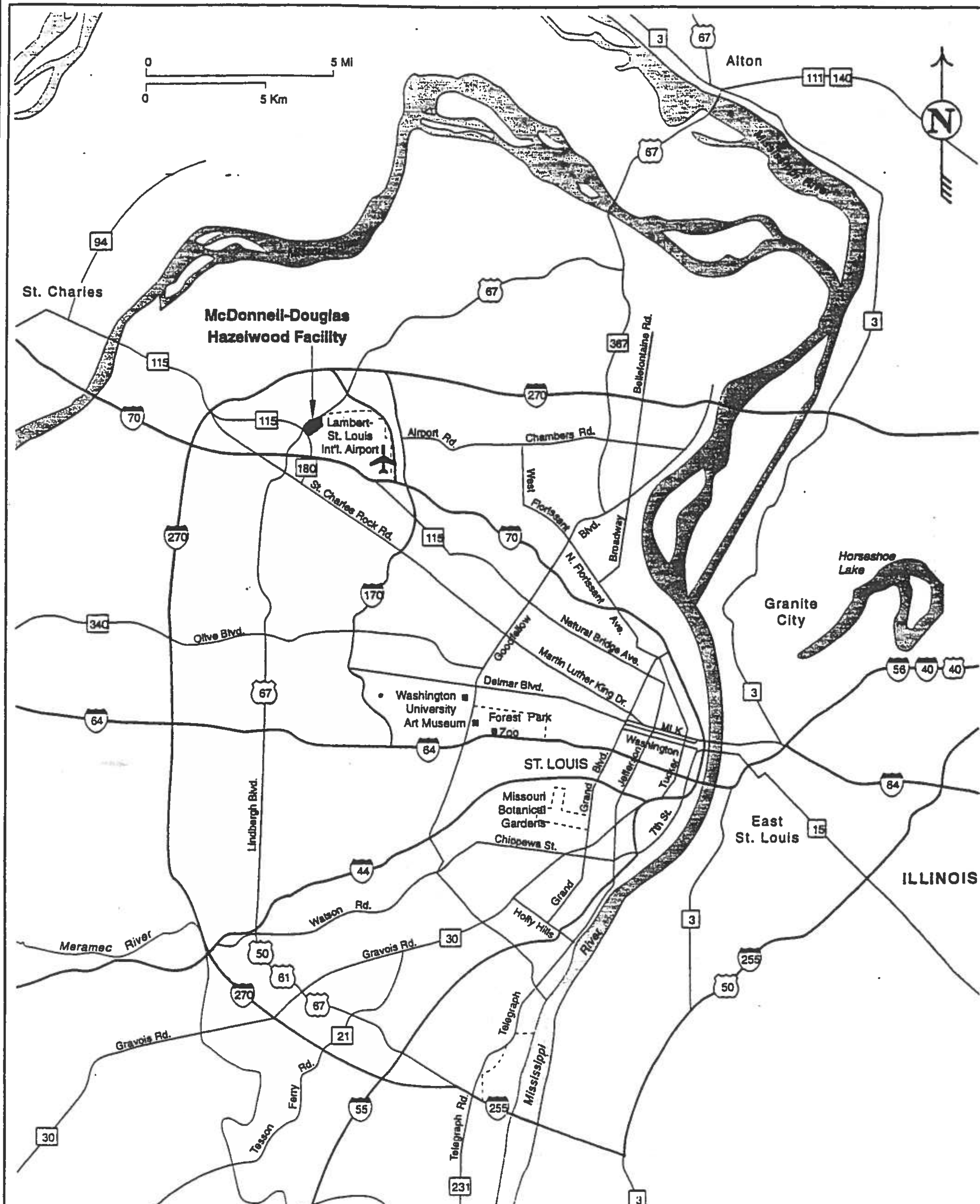

Figure 1-1

Facility Location Map

McDonnell-Douglas, Hazelwood

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Building No.	Description
20, 30A	Electrical Substation & Pump House
22	Garage Building
23	Cooling Tower
24	Pedestrian Underpass (East)
25, 25A	Wind Tunnel (Low Speed) Unit Substation
25B	V/STOL Test Facility
26	Pump House (Fire Protection)
26A	Storage Tank (Fire Protection)
27	Manufacturing Building
28	Fuel System Laboratory
29	Fabrication Building
29A	Composites Manufacturing

Building No.	Description
30, 30A	Pedestrian Underpass (West)
32	Office Building
33	Office Building
34	Office Building
39	Chemical Storage Building
211, 214	Guard Shelters
215	Bus Shelter (McDonnell Blvd.)
216	Die Storage Rack
220	Composites Manufacturing
220A	Unit Substation
221	Office and Engineering Laboratories

1	Administrative Offices
2	Manufacturing Building
3	Office Annex Building
4	Office Building
5	Boiler House
5A, B	Sprinkler System Storage Tank
6	Maintenance Building
7	Gate House
19	Compass Rose
40	Ramp Service Building
41	Chemical Storage Building
42	Production Hangar
43	Ramp Utilities Building
43A, B, C, D	Storage Tanks (Ramp H_2O & Air Serv.)
44	Pump House (Fire Protection)
45	Production Hangar
45A, B, F, G	Ramp Shelters
45C, D, E, L	Hush Houses
45J	Radar Cooling Equipment Building
45K	Fuel System Work Facility
45L	Hush House #4
46	Fuel-Filter Building
48	Ramp Paint Booths
49, 49A	Water Check Facility
51	Manufacturing Building
52	Manufacturing Building
53	Boiler House
55	Service Building
55A	Storage Building
56	Boiler House

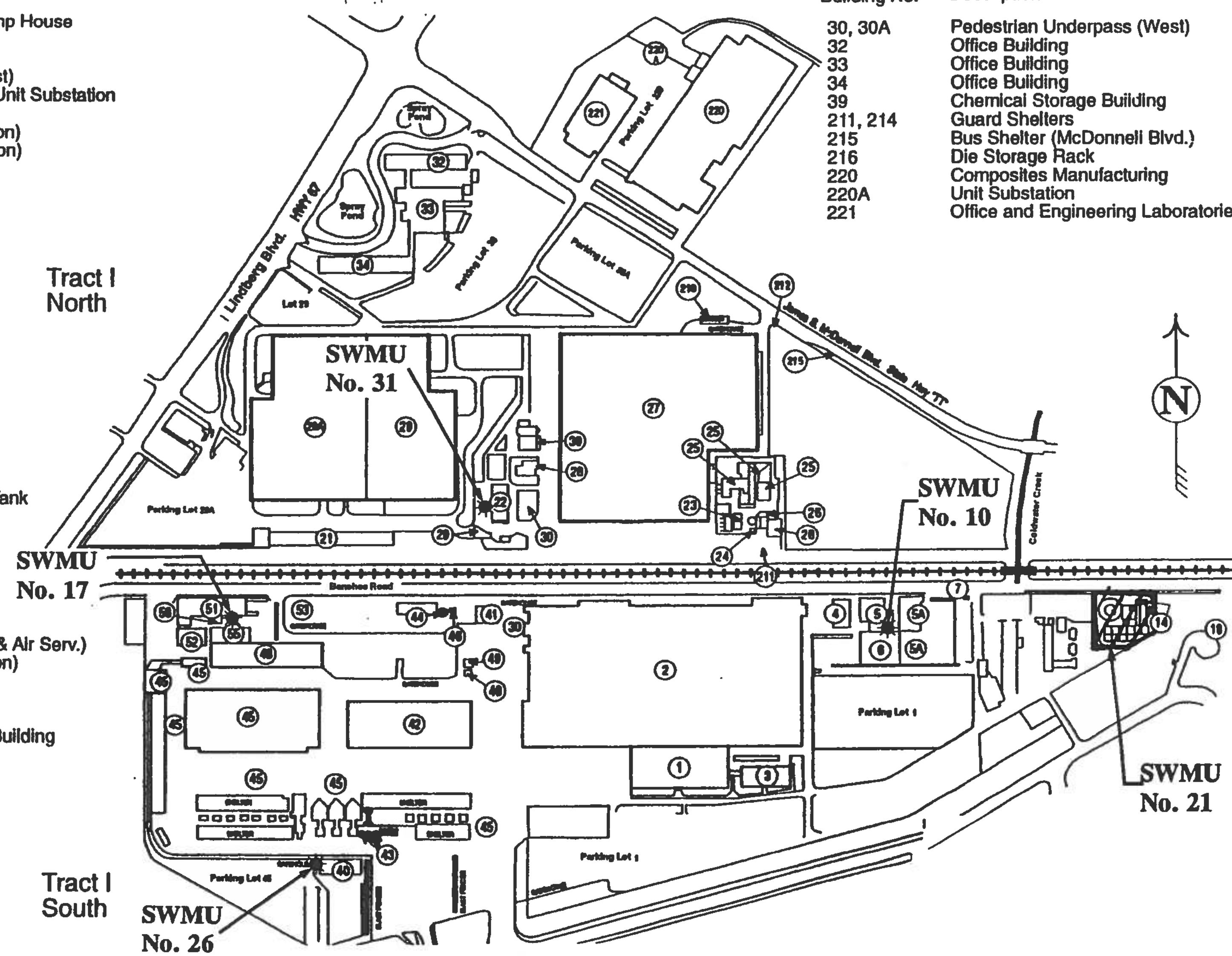

Figure 1-2

Layout of Facility and SWMU Locations

McDonnell-Douglas, Hazelwood

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RFI SCHEDULE

	START DATE	DURATION (DAYS	END DATE
Submittal of RFI Workplan to MDNR	5-30-97	3	6-3-97
RFI Workplan Review & Comment by MDNR	6-3-97	45	7-18-97
Revise & Submit Final RFI Workplan based on MDNR Review	7-19-97	20	8-7-97
Receive Authorization to Proceed & Mobilization Time	8-8-97	14	8-21-97
Field Investigation	8-22-97	7	8-28-97
Laboratory Analysis	8-29-97	30	9-27-97
Internal Draft RFI Report Prepared	9-28-97	30	10-27-97
MD Review of Draft RFI Report & Submittal to MDNR	10-28-97	30	11-26-97
Draft RFI Report Review & Comment by MDNR	11-27-97	30	12-26-97
Revise & Submit Final RFI Report based on MDNR Review	12-27-97	20	1-15-98

1997 MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC | 1998 JAN

Figure 2-1
RFI SCHEDULE
RFI WORKPLAN FOR McDONNELL DOUGLAS
HAZELWOOD, MISSOURI FACILITY

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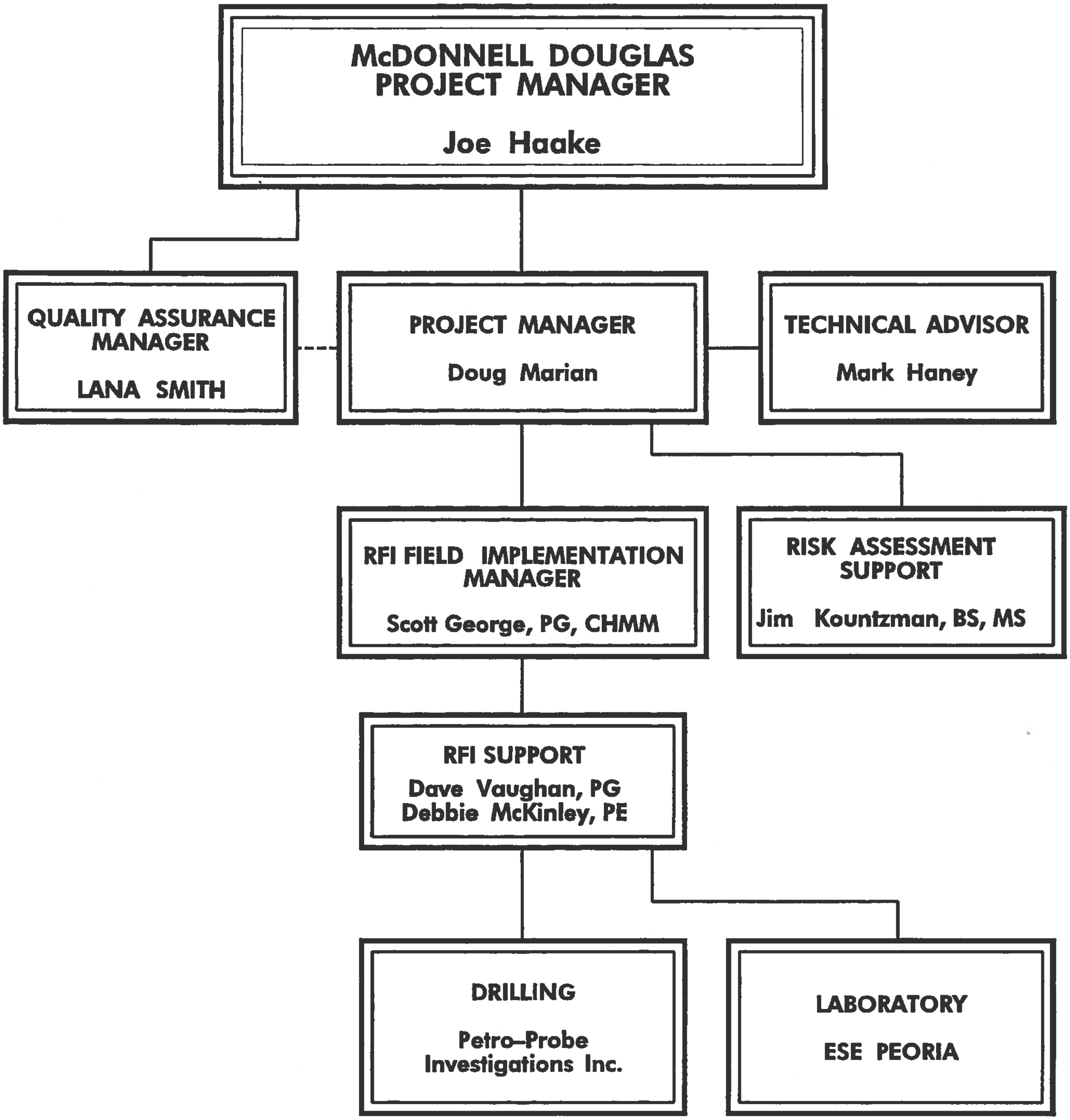

Figure 2-2
PROJECT ORGANIZATION CHART
RFI WORK PLAN FOR McDONNELL DOUGLAS
HAZELWOOD, MISSOURI FACILITY

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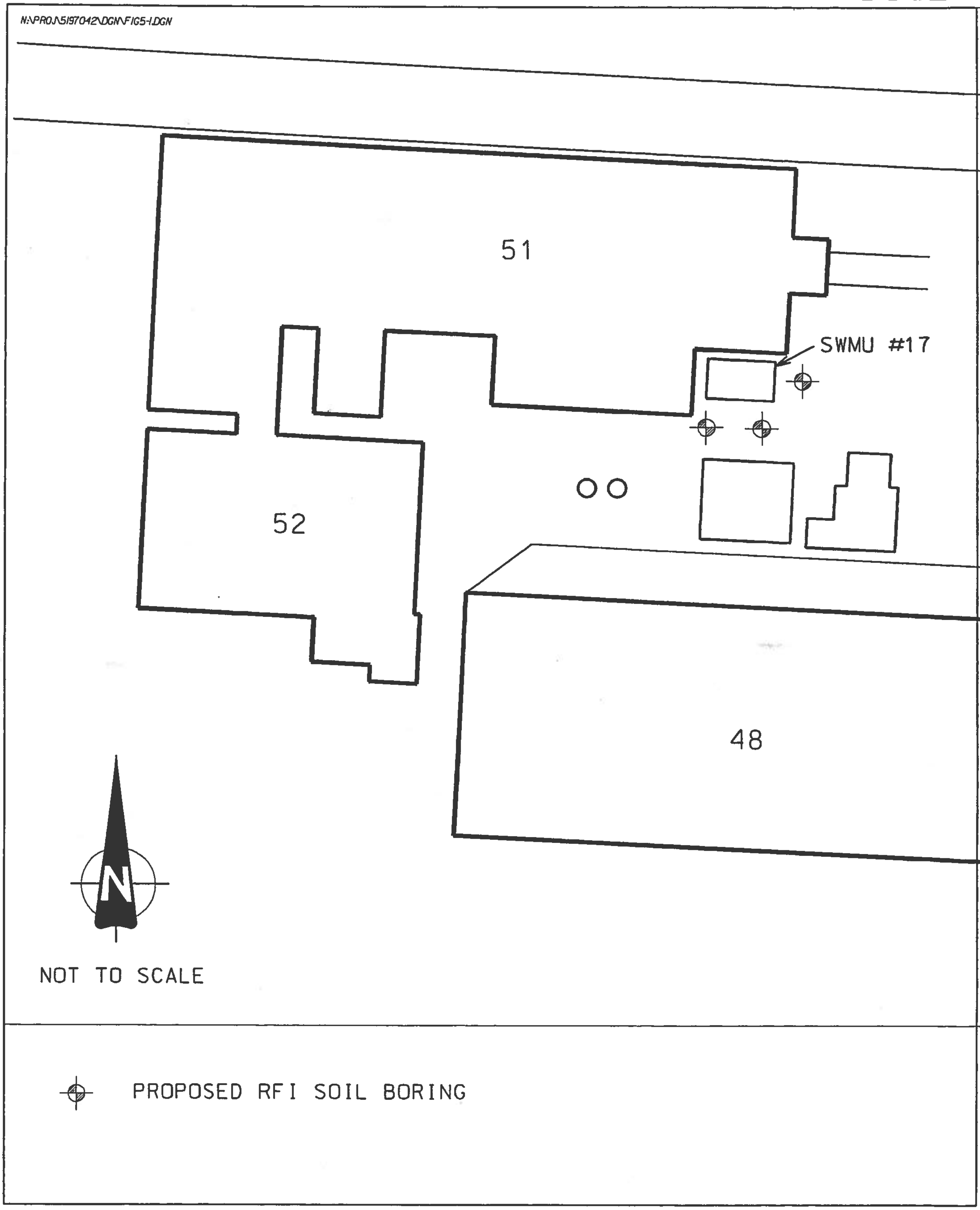

Figure 3-1
PROPOSED RFI BORING LOCATIONS FOR SWMU NO. 17 – TRANSFER AREA FOR RECOVERED PCE
McDONNELL DOUGLAS FACILITY
HAZELWOOD, MO

ESE Environmental Science & Engineering, Inc.
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N:\PROJ\5197042\DGN\FIG5-2.DGN

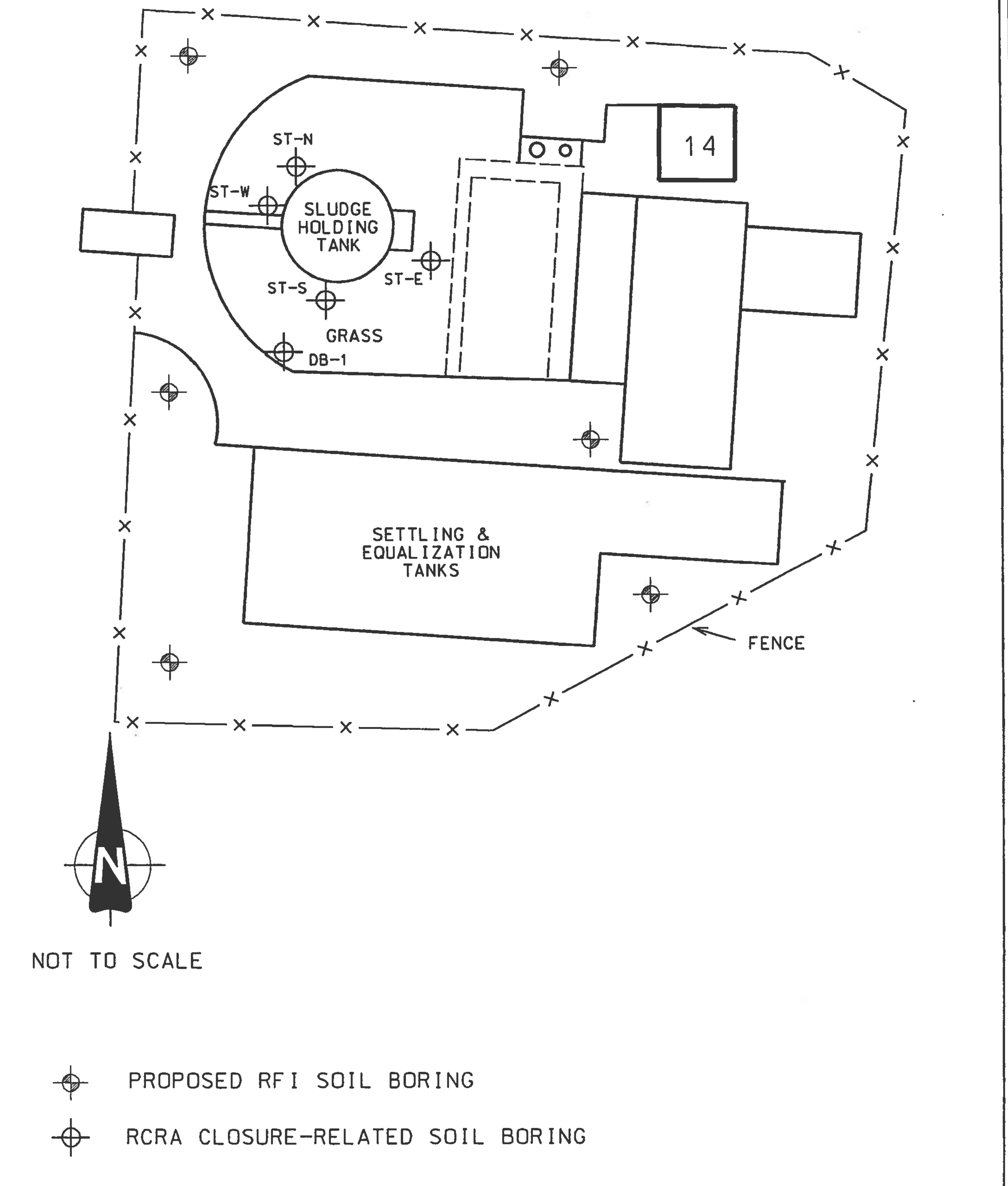

Figure 3-2
PROPOSED RFI BORING LOCATIONS FOR SWMU NO. 21 - INDUSTRIAL WASTEWATER TREATMENT PLANT (IWTP)
McDONNELL DOUGLAS FACILITY, HAZELWOOD, MO

Environmental Science & Engineering, Inc.
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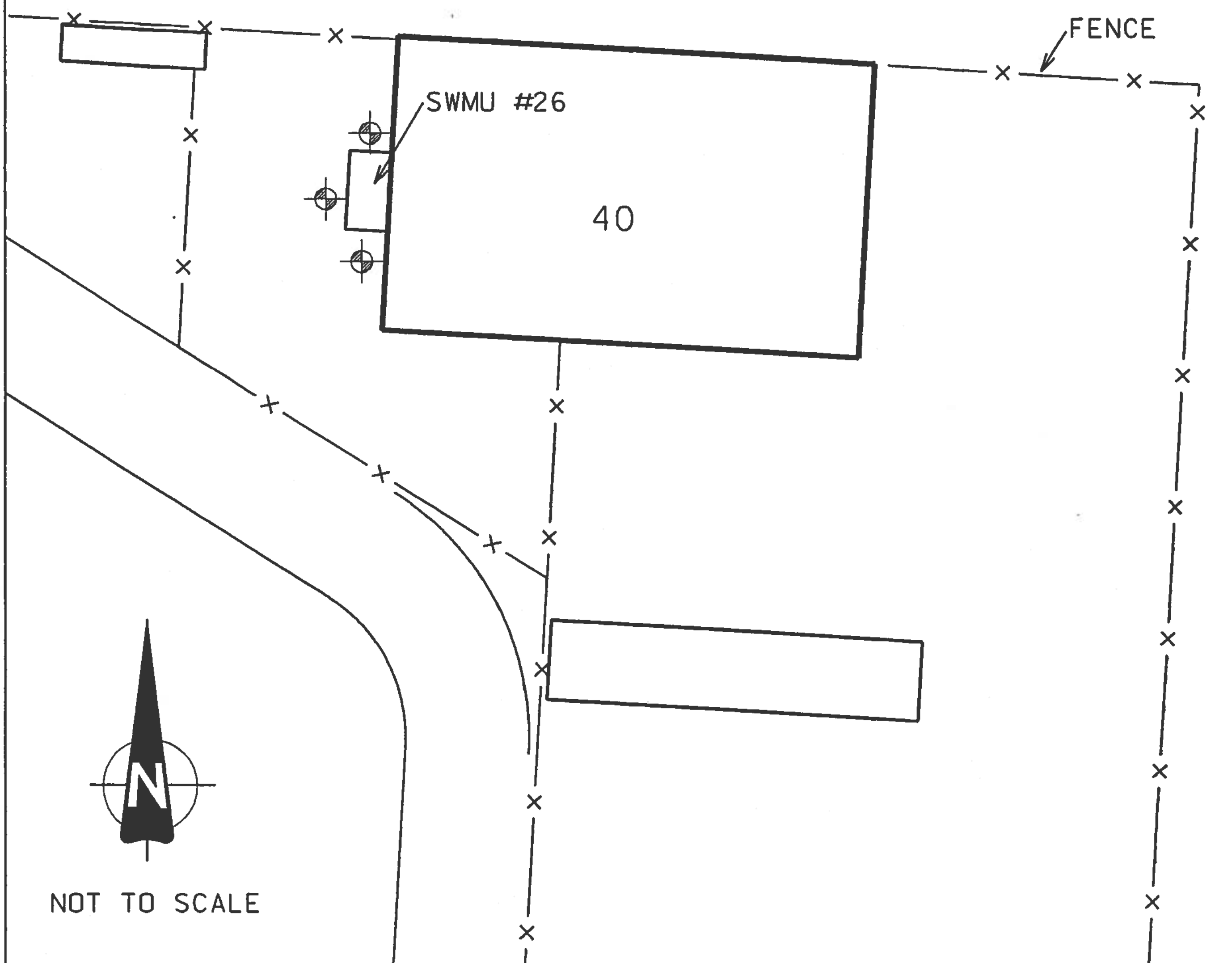
N:\PROJ\5197042\DGN\FIG5-3.DGN



PROPOSED RFI SOIL BORING

Figure 3-3
PROPOSED RFI BORING LOCATIONS FOR SWMU NO. 26 - FORMER LESS-THAN-90-DAY STORAGE BUILDING
McDONNELL DOUGLAS FACILITY, HAZELWOOD, MO

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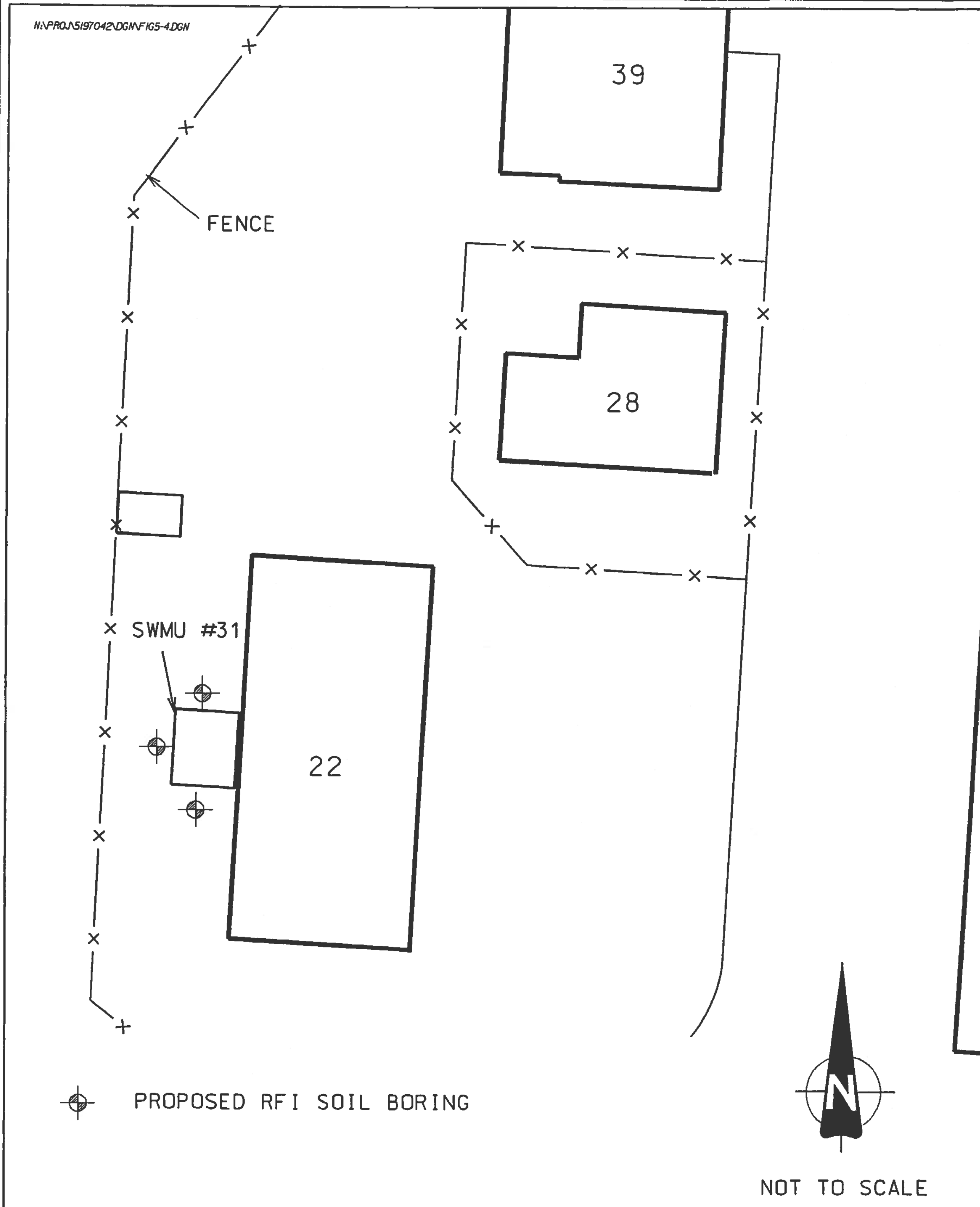

Figure 3-4
PROPOSED RFI BORING LOCATIONS FOR SWUM NO. 31 – WASTE OIL TANK AT BUILDING 22 McDONNELL DOUGLAS FACILITY, HAZELWOOD, MO

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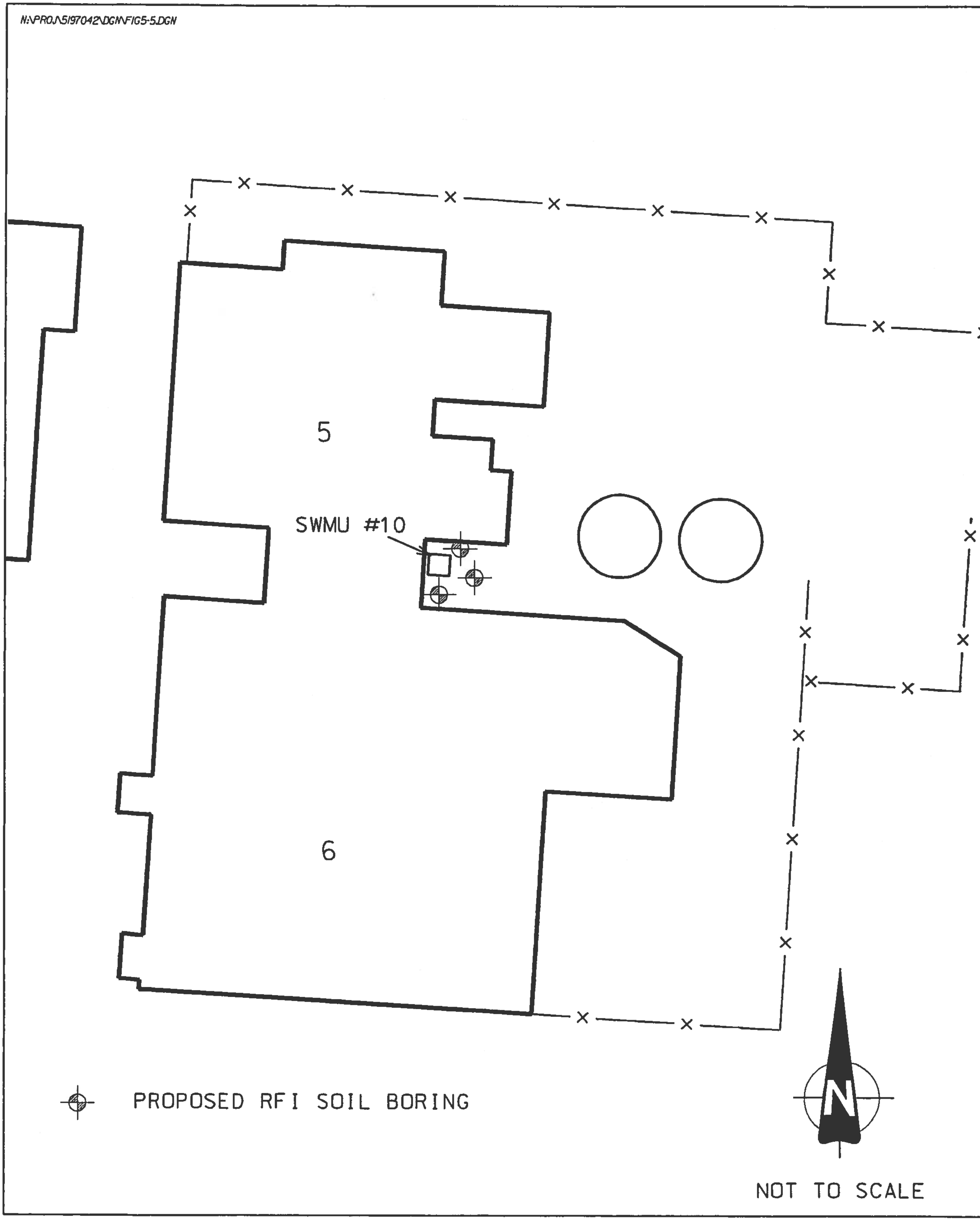

Figure 3-5
PROPOSED RFI BORING LOCATIONS FOR SWMU NO. 10 - WASTE OIL TANK AT BUILDING 5 McDONNELL DOUGLAS FACILITY, HAZELWOOD, MO

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Appendix

Appendix A

Quality Assurance Project Plan

(Provided in Volume II)

Appendix B

Health & Safety Plan

(Provided in Volume III)